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Implementation of International Marine Law in Maintaining Marine Wealth (Fukushima Nuclear Waste Disposal)

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ABSTRACT

This paper examines the legal and environmental impacts of Japan's nuclear waste disposal policy and its implications for international relations with neighbouring countries. Using the theory of state obligations and responsibility as a theoretical framework, the research applies a normative approach. The sea, as a vital natural resource, must be protected from pollution, and coastal nations, including Japan, are obligated to preserve it. Japan has developed nuclear power to replace coal and petroleum for electricity generation, reducing carbon emissions and addressing resource limitations. However, nuclear power presents significant challenges in managing nuclear waste, which is difficult to decompose and requires secure storage. With no available space to store its growing nuclear waste, Japan decided to dispose of it in the Pacific Ocean. This decision raised concerns about marine pollution and triggered responses from neighboring countries such as South Korea, Hong Kong, Macau, and China, which halted seafood imports from Japan. This research aims to analyze the legality of Japan's actions, assess their environmental impact, and explore the consequences for international relations in the region.

Keywords: nuclear waste; state obligation; marine pollution.

INTRODUCTION

From August 24 to September 11, 2023, the Japanese government began discharging nuclear waste from Fukushima into the sea. This waste originated from the Fukushima nuclear power plant, which has been accumulating since the tsunami that struck Japan in 2011. A total of 1.34 million tons of nuclear waste was released into the Pacific Ocean, citing that storage capacity had reached its maximum and could no longer accommodate additional nuclear waste. This action by the Japanese government raises questions about the regulations of international maritime

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law regarding the protection of the marine environment.[1] Currently, 31 countries utilize nuclear power as a source of electricity. Nuclear energy is believed to have capabilities comparable to coal and oil; however, it produces significantly lower levels of harmful carbon emissions compared to coal and oil.[2]

Nuclear energy in Japan has been developing since 1966 and is used by the Japanese government as a source of electricity generation. Japan produces 30% of its electricity from several reactors, and this percentage increases each year.[3] Before the nuclear accident in 2011, Japan was one of the countries with the highest number of nuclear reactors, operating 33 reactors. However, Japan is still in the recovery process, and currently, only about 11 reactors are operational.[4]

The Japanese government's actions were authorized by the International Atomic Energy Agency (IAEA), a UN-established organization. Through the Advanced Liquid Processing System (ALPS), the IAEA declared that the discharged nuclear waste is safe. The remaining tritium content is 1,500 becquerels per liter. The World Health Organization (WHO) has set the maximum threshold for tritium at 60,000 becquerels per liter. For drinking water, the highest allowable threshold for tritium is 10,000 becquerels per liter.[5]

Nuclear energy offers many benefits, but it also comes with several adverse effects caused by nuclear radiation. Reactors produce nuclear waste that emits radiation; therefore, nuclear waste must be treated properly before disposal. This is because the radiation contained in nuclear waste can pose significant dangers to humans.[6] In addition, a significant impact of disposing of nuclear waste into the sea is marine pollution. This pollution can affect all human activities in the ocean and has a very wide reach. It can also have adverse effects on coastal countries.

The actions of the Japanese government not only impact the environment but also affect relations with neighboring countries. International law establishes several principles related to environmental protection, one of which is the **Good**

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[1] CNBC Indonesia. (2023). "Jepang Buang Air Limbah Nuklir ke Laut Pasifik Lagi 7800 ton". (cnbcindonesia.com, 6 October). https://www.cnbcIndonesia.com/news/20231006125815-4-478483/Jepang-buang-air-limbah-nuklir-ke-laut-pasifik-lagi-7800-ton.[C].

[2] Direktorat Jenderal Energi Baru Terbarukan dan Konvervasi Energi. (2016). "IAEA: 31 Negara telah Mengoperasikan PLTN". https://ebtke.esdm.go.id/post/2016/10/12/1378/iaea.31.negara.telah.mengoperasikan.pltn. [Accessed on August 6, 2024].

[3] World Nuclear Association. (2024). "Nuclear power in Japan". (worldnuclear.org, 3 December). https://world-nuclear.org/information-library/country-profiles/countries-g-n/japan-nuclear-power. [Accessed on August 10, 2024].

[4] *Ibid.*

[5] *Ibid.*

[6] Universitas Medan Area (2023). "Apa saja Dampak Positif dan Negatif Energi Nuklir?". https://bakai.uma.ac.id/2023/04/08/apa-saja-dampak-positif-dan-negatif-energi-nuklir/. [Accessed on August 10, 2024].

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Neighbourliness Principle. This principle stipulates that the activities of one country must not cause environmental harm to another country.[7] As stipulated in Article 74 of the UN Charter regarding the Principle of Good Neighbourliness. The actions taken by Japan have sparked numerous reactions from various countries, especially neighboring nations such as South Korea, Hong Kong, Macau, and China. These countries oppose Japan's actions, expressing concerns about the potential contamination of the marine environment and the natural resources found in the sea.

There are two different legal perspectives regarding the actions taken by the Japanese government: International Maritime Law and International Nuclear Law. Article 192 of the United Nations Convention on the Law of the Sea (UNCLOS) 1982 stipulates that countries are obligated to protect and preserve the marine environment from contamination, including pollution from waste.[8] In addition, Article 198 of the United Nations Convention on the Law of the Sea (UNCLOS) 1982 states that a country is obligated to notify other countries that may be affected by potential damage due to pollution.[9]

In addition to UNCLOS 1982, there are several conventions that regulate environmental protection, one of which is the Stockholm Convention 1972. Point 18 of the Stockholm Convention states that science and technology should be used to preserve the environment, and thus, countries should avoid developing technologies that have the potential to harm the environment.[10] The **Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter** 1972 (London Convention 1972) establishes that countries have an obligation to take actions to prevent pollution that could cause transboundary contamination, as outlined in Article 1.[11] The **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes** governs the regulation of waste movement, as outlined in Article 9. These three conventions—UNCLOS 1982, the Stockholm Convention 1972, and the London Convention 1972—collectively regulate the protection of the environment, ensuring that countries adhere to practices that prevent pollution and harmful environmental impact

[7] Tri Wiharjanti dan Diah Apriani Atika sari. (2016). Prinsip Good Neighborliness dalam Pencemaran Asap Lintas batas (Transboundary Haze Pollution) di Kawasan ASEAN. *Jurnal Hukum Universitas Sebelas Maret* Volume 2 (No.2), p. 2.
[8] United Nations, United Nations Convention on the Law of the Sea 1982, Article 192.
[9] Rheina Zetiah Akhtar Chulaizinda Azis. (2019). Pertanggungjawaban Indonesia Terhadap Thailand Atas Sampah Laut Lintas Batas Negara. *Skripsi Sarjana Hukum Fakultas Hukum Universitas Negeri Surabaya.* p.15.
[10] Garnida and Syam, "Uji Coba Nuklir Dalam Perspektif Hak Asasi Manusia Dikaitkan Dengan Non-Proliferation Treaty (NPT) dan Comprehensive Test Ban Treaty (CTBT).", See also, Declaration of the United Nations Conference on the Human Environment (Stockholm Convention'1972), Point 18.
[11] "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter.", Article 1

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across borders.[12] The **Stockholm Convention 1972** regulates that in order to help an environment develop, countries can utilize technology and knowledge gained from scientific research. Therefore, when creating technology, it should not harm the environment. The convention emphasizes the importance of using scientific advancements in a way that supports environmental preservation. The sea is a vast area that borders other countries, and if pollution occurs, there is a concern that it could harm the environment of neighboring countries. Therefore, Japan, as a country neighboring others, is obligated to protect the environment and ensure that its actions do not harm the territories of other countries.

Based on the explanation above, the author concludes several points related to the issues discussed in this paper. First, Japan, as a country that has ratified UNCLOS 1982, has an obligation to protect the seas from environmental pollution. Therefore, the action of discharging Fukushima nuclear waste into the sea raises questions about how Japan fulfills its responsibility to preserve the ocean from contamination. Second, by considering Canada and the United States as countries that actively use nuclear power and face similar challenges in managing nuclear waste, this study will examine how these two countries regulate the laws and technologies applied in managing nuclear waste to prevent environmental damage.

RESEARCH METHOD

In this paper, the author employs a normative research method. The normative method is a scientific writing approach aimed at seeking truth based on scientific logic from a normative perspective.[13] This writing utilizes several sources, including UNCLOS 1982, the 1954 Nuclear Safety Convention, and the 1972 London Convention. Additionally, this research also makes use of articles, journals, and various sources from the internet.

DISCUSSION

Japan's Obligation to Protect the Marine Environment

Japan ratified the London Convention in 1980, a convention that regulates the prevention of marine pollution caused by waste. For monitoring and researching the marine environment, Japan has established an environmental agency since 1975.

[12] "Basel Convention on the Control of Transboundary Movements of Hazardous Wastes | UNEP - UN Environment Programme.", Article 9.
[13] Vidya Prahassacitta, Penelitian Hukum Normatif dan Penelitian Hukum Yuridis, *Jurnal Hukum Binus*, 2019, https://business-law.binus.ac.id/2019/08/25/penelitian-hukum-normatif-dan-penelitian-hukum-yurudis/.

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Cooperation among the coastal countries bordering the Sea of Japan is carried out to implement action plans for the protection, management, and development of the marine environment, with a focus on safeguarding both the Japanese Sea and the Yellow Sea.[14]

Japan ratified the UNCLOS 1982 on June 20, 1996.[15] In this convention, it is emphasized that no country's activities should cause pollution to the marine environment. Additionally, Article 27 of the 1997 Joint Convention on the Safety of Spent Fuel Management and the Management of Radioactive Waste states that the disposal of radioactive waste must not occur beyond 60 degrees south latitude and should not endanger the freedom of navigation of other countries or their rights.[16]

As a result of the nuclear waste disposal actions taken by the Japanese government, several neighboring countries have protested, including China, South Korea, and Hong Kong. South Korea began protesting Japan's actions after the Fukushima Daiichi nuclear power plant accident in 2011. Following the incident, in 2013, South Korea took measures to ban the import of seafood and food products from Japan. The South Korean government expressed concerns that water contaminated with high-level radionuclides could pollute the ocean. To this day, South Korea continues to suspend the import of seafood products from Japan. The South Korean government has voiced its concerns about the safety of Japanese seafood products and has urged Japan to stop discharging nuclear waste into the sea.[17]

Japan filed a lawsuit against South Korea through the World Trade Organization (WTO) on the grounds that South Korea violated several articles of the SPS Agreement (Sanitary and Phytosanitary Measures). Japan argued that South Korea's actions were not based on international standards and were unjustified, particularly regarding the import ban on seafood and food products from Japan.[18] At the beginning of the trial, South Korea was found to have violated several articles of the SPS Agreement and was deemed to have failed to comply with transparency obligations. However, the South

[14] Ministry of the Environment Government of Japan. "Global Environment". https://www.env.go.jp/en/earth/marine/ conservation.html. [Accessed on August 7, 2024].
[15] United Nations. "Treaty Collection". https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21&Temp=mtdsg3&clang=_en#:~:text=16%20November%201994%2C%20in%20accordance%20with%20Article%20308(1). [Accessed on August 10, 2024].
[16] Yen-Chiang Chang, Xiaonan Zhao, Anqi Jian, Ying Tan. (2024). "Frontier issues in International Ocean Governance: Japan's discharge of Nuclear contaminated water into the sea". *Science Direct Journal*. https://www.sciencedirect.com/science/Article/pii/S0025326X23012882. See also, Joint Covention 1997 Article 27.
[17] Yoshimichi Ishikawa. (2023). "Fukushima Revisited: ALPS Water Release China's Import Ban and the SPS Agreement at the WTO. *Ejil Talk*." https://www.ejiltalk.org/Fukushima-revisited-alps-water-release-Chinas-import-ban-and-the-sps-agreement-at-the-wto/. See also, The Japan News, China, H.K. to toughen Import Restrictions on Japanese Food, on the page https://japannews.yomiuri.co.jp/world/asia-pacific/20230824-131638/.4
[18] Suryani. (2020). Peran World Trade Organization (WTO) dalam Penyelesaian Sengketa Perdagangan Larangan impor Produk Perikanan Jepang oleh Korea Selatan. *Jurnal Hukum Kampus Bina Widya*, p. 5.

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Korean government appealed, arguing that the scientific evidence provided by Japan was insufficient regarding the quantity and types of radionuclides released after the accident. The appellate body decided to overturn the previous panel's ruling and ruled in favor of South Korea. The court found that the panel had failed to properly analyze Japan's testing methods for contamination, and determined that Japan's methods did not meet the standards set by South[19]

In 2023, China announced that it would take similar actions to South Korea by imposing a comprehensive suspension of aquatic product imports from Japan. The decision was made to prevent risks associated with radioactive contamination from the nuclear waste Japan had discharged into the sea. Based on China's food safety laws and the WTO Agreement on the Application of Sanitary and Phytosanitary Measures, China decided to suspend the import of aquatic products from Japan.[20]

Hong Kong also joined in refraining from consuming and importing food products from Japan. There are specific food items banned from being imported based on their location. For example, from Fukushima, Hong Kong has prohibited the import of vegetables, fruits, milk, and powdered milk. However, from other areas close to Fukushima, such as Ibaraki, Tochigi, Chiba, and Gunma, the same products are allowed for import, but they must be accompanied by an exporter's certificate and a radiation certificate. For meat or eggs, a radiation certificate is also required.[21] Macau announced a ban on the import of food products from Japan. This ban includes animal and fresh products, food, sea salt, and seaweed originating from Fukushima and surrounding areas, including Chiba, Tochigi, Ibaraki, Gunma, Miyagi, Niigata, Nagano, Saitama, and Tokyo.[22]

International organizations have expressed their stance on Japan's nuclear waste disposal actions. The **International Atomic Energy Agency (IAEA)** provided technical support by reviewing the safety and transparency of the implementation process. The IAEA's involvement aims to ensure that Japan's handling of the nuclear waste disposal meets international safety standards and is conducted transparently.[23] The IAEA

[19] *Ibid*, p. 6.
[20] *Ibid*, see also, General Administration of Customs of the Peoples's Republic of China, Announcement on the Comperhensive Suspension of Imports of Japanese Aquatic Products.http://www.customs.gov.cn/customs/302249/302266/302267/5277845/index.html. [Accessed on August 6, 2024].
[21] Yoshimichi Ishikawa. *Loc, Cit*. p. 3. See also, Centre for food Safety, Control Measures on Foods Imported From Japan, https://www.cfs.gov.hk/english/programme/programme_rafs/programme_rafs_fc_01_30_Nuclear_Event_and_Food_Safety_03.html. [Accessed on August 6, 2024].
[22] *Ibid,* see also, Annoucement Macau Goverment https://www.maff.go.jp/j/export/e-shorisui/attach/pdf/kaiyou_houshutsu-2.pdf. [Accessed on August 6, 2024].
[23] Yen-Chiang Chang, Xiaonan Zhao, Anqi Jian, Ying Tan, *Loc. Cit,* p. 7, see also, IAEA, *IAEA* Comprehensive Report on The Safety Review of The ALPS-Treated Water at The Fukushima Daiichi Nuclear Power Satiation. https://www.IAEA.org/topics/response/Fukushima-daiichi-alps-treated-water-discharge-comprehensive-reports.

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conducted research and published a report, in which they emphasized that the release of treated water from the Fukushima nuclear power plant was a decision made by the Japanese government. The report clarified that the IAEA's findings were not recommendations or endorsements, and it reaffirmed that the IAEA remains neutral regarding the policies implemented by the Japanese government.[24] The IAEA has the responsibility to maintain transparency regarding the radioactive levels contained in the waste discharged by Japan. This includes monitoring and providing accurate information on the safety and potential environmental impact of the release, ensuring that the process adheres to international standards.

The **Office of the High Commissioner for Human Rights (OHCHR)**, as the organization responsible for protecting human rights, provided its opinion on the actions taken by the Japanese government. OHCHR emphasized the importance of prior consultation regarding the potential impacts on both the Japanese population and neighboring countries. The OHCHR expressed concern about the potential consequences of radiation exposure, particularly for workers and communities who may be affected by the nuclear waste disposal process.[25]

Next, the non-governmental organization **Greenpeace** also voiced its opinion. Greenpeace assessed that the radioactive waste from the Fukushima power plant would pose a unique radioactive threat to the Pacific Ocean and other regions in the medium to long term. The plan created by TEPCO (Tokyo Electric Power Company) is currently considered inadequate for restoring the environment in the Fukushima area to its state prior to the 2011 nuclear accident. Greenpeace criticized TEPCO's assessment, arguing that it is limited in scope, making it difficult to determine the broader environmental impact.[26]

Japan has experienced several nuclear energy-related accidents, particularly after the Fukushima nuclear power plant incident. The disaster caused significant damage to the population and sparked negative reactions from several neighboring countries. In response to the accident, the Japanese government issued various regulations and disaster management procedures, including compensation measures, as part of its responsibility for the incident. These actions aim to address the aftermath and mitigate the impact on affected communities and the environment.

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[24] *Ibid*.
[25] *Ibid*.
[26] *Ibid*. See also, Greenpeace East Asia, Comments TEPCO radiological impact assessment report regarding the discharge of ALPS reated water into the sea (design stage). https://www.greenpeace.org/static/planet4-japan-stateless/2021/12/9a52607f-public-comment-on-Fukushima-radiological-assessment-.pdf. [Accessed on August 7, 2024].

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As mentioned, compensation is one form of state responsibility, according to the *Articles on the Responsibility of States for Internationally Wrongful Acts* (2001). Japan, as a country that experienced a nuclear accident in 2011, has established regulations regarding compensation for affected communities. However, the process became burdensome for many people, as TEPCO, the operator of the Fukushima nuclear power plant, required a 54-page compensation registration form. As a result, many victims did not file claims for compensation. Additionally, the Japanese government set standard compensation amounts for farmers and fishermen who suffered losses due to the accident. However, many farmers did not meet these standards and, despite facing significant losses, were not granted any compensation. In response to this criticism, TEPCO later offered 200,000 yen as voluntary compensation to affected individuals.[27]

Compensation in Japan is governed by the **Nuclear Compensation Act No. 147 of 1961**, which serves as a no-fault compensation system for nuclear accidents. Under this law, the damages caused by events such as earthquakes or tsunamis are handled differently. Section 3 of this law outlines the responsibility of **TEPCO** (Tokyo Electric Power Company), the operator of the nuclear reactor. The operator can be exempted from liability if the nuclear accident is caused by a natural disaster. This provision helps distinguish between accidents caused by human error or technical failure and those resulting from unforeseen natural events.[28]

Domestic law in Japan only governs responsibilities to Japanese citizens who suffer damages. The Japanese domestic law is limited to compensating Japanese citizens affected by nuclear accidents, and Japan did not sign the **Paris Convention** of 1960, which sets forth third-party liability in the field of nuclear energy. However, Japan is one of the signatories of the **Vienna Convention on Civil Liability for Nuclear Damage**, adopted in 1963. Japan is also a party to the **Nuclear Safety Convention**, which was established by the IAEA (International Atomic Energy Agency) in Vienna in 1994. In 1994, the IAEA strengthened its regulatory authority through conventions that establish standards for member countries, though verification of compliance with these standards remains challenging.

International environmental law has proposed a series of principles requiring all countries to bear legal responsibility if their actions violate international obligations and cause transboundary damage to human life, property, and the environment.

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[27] Upik Sarjiati. (2019). Risiko Nuklir dan Respon Publik terhadap Rencana Nuklir Fukushima di Jepang. *Jurnal Kajian Wilayah Pusat Penelitian Sumberdaya Regional, Lembaga Pengetahuan Indonesia* Volume 9 (No.1), p. 6. https://jkw.psdr.lipi.go.id/index.php/jkw/Article/view/785/546, p. 6.

[28] Meng Li, Xuendong Wang. Legal Responses to Japan's Fukushima Nuclear Wastewater Discharge into the sea- From the Perspective of China's right safeguarding strategies. *Jurnal hukum National Library of Medicine*. https://www.ncbi.nlm.nih.gov/pmc/Articles/PMC10172886/#sec3. See also, Feldman Eric. Fukushima: catastropne, compensation and justice in Japan.

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The responsibility of states for nuclear waste pollution in the sea has not yet been addressed by international conventions. In contrast, marine oil pollution is governed by the **International Convention on Civil Liability for Oil Pollution Damage (CLC 1969)**, which establishes a uniform national system and outlines the liability of tanker owners to compensate victims for damages caused by oil spills. This convention provides a clear framework for ensuring that those responsible for oil pollution are held accountable and compensate affected parties, but similar regulations for nuclear waste disposal at sea are still lacking on an international level.[29]

There have been several cross-border pollution cases, such as the **Trail Smelter case** in 1941, which involved Canada and the United States. This case occurred due to cross-border pollution that harmed the United States. It led to the establishment of the **Polluter Pays Principle**, which holds that the polluter is responsible for paying for the damage caused. The court emphasized that a country does not have the right to engage in activities that cause harm to the territory of another country. This case taught that a country can engage in activities that pollute its own territory as long as they comply with national regulations and do not harm others. However, if such activities harm another country and violate its sovereignty, the responsible country must bear the responsibility, which may include compensation, satisfaction, or restitution according to international law.[30]

Technological advancements have led to an increasing demand for electricity, with nuclear energy emerging as a significant alternative to fossil fuels. Nuclear energy offers advantages such as freedom from pollution and greenhouse gas emissions, generating only water vapor as a pollutant. However, these benefits do not eliminate the nuclear risks that can be used as weapons, as seen in the atomic bombings of Hiroshima and Nagasaki. Despite non-proliferation agreements aimed at promoting peaceful uses of nuclear energy, the risk of misuse remains, particularly in unstable countries. Additionally, nuclear energy requires high costs and extended periods for building power plants, although its operation is relatively simple. This can be a barrier in efforts to reduce pollution.[31]

The disposal of radioactive waste is governed by specific conventions due to the need for ensuring the safety of both society and the environment during the disposal process. These conventions are established because waste disposal requires the

[29] Rehulina S.H., M.H., Hemanto, T. Jessica Novia *Loc. Cit*. p. 69. Hukum Laut Internasional Dalam Perkembangannya. *JusticePublisher*. http://repository.lppm.unila.ac.id/2825/1/hukum%20kelautan.pdfhttp://repository.lppm.unila.ac.id/2825/1/hukum%20kelautan.pdf.
[30] *Ibid,* see also, *Fiat Justitia*, Analisis Kasus Trail Smelter, http://aswansidraplawyer.blogspot.com/2018/05/analisis-kasus-trail-smelter.html, [Accessed on August 10, 2024].
[31] Earth Org (2023). "The Advantages and Disadvantages of Nuclear Energy". (earth.org, 28 Januari). https://earth.org/the-advantages-and-disadvantages-of-nuclear-energy/. [Accessed on August 6, 2024]

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implementation of measures that protect human health and the environment. Improper management of radioactive waste can result in harmful consequences for human health and the environment, both in the present and in the future. Therefore, international agreements and regulations are in place to ensure that the disposal of radioactive waste is carried out safely and responsibly, minimizing any potential risks.[32]

The disposal of radioactive waste is regulated by supervisory bodies, which may consist of one or more organizations recognized by the government and holding licenses. These supervisory bodies are entrusted with the responsibility of regulating and creating effective regulations, while remaining independent institutions that are accountable for developing practices in line with legal provisions. The functions of the supervisory bodies include drafting regulations, reviewing applications for the disposal of radioactive materials into the environment, issuing permits, and either approving or rejecting applications. They also conduct regular inspections, enforce laws related to violations of regulations, standards, and licensing conditions, and assess the effectiveness of measures to protect humans from the impact of radioactive waste releases.

The authority of the supervisory body must be clearly defined to ensure consistent law enforcement, as one of the key powers of the supervisory body is the ability to review appeals regarding the disposal of radioactive waste. Therefore, the regulations between the supervisory body and legal entities must be clear and well-established. This clarity ensures that the supervisory body can effectively perform its role in monitoring, regulating, and enforcing the safe disposal of radioactive waste, while also providing a transparent and fair process for addressing disputes or appeals. Proper legal frameworks and clear guidelines are essential for maintaining accountability and the protection of both human health and the environment.

The first step in the disposal of radioactive waste is to notify the supervisory body to obtain authorization for the disposal process. Following that, the type of waste to be disposed of must be determined, including whether the waste is exempt from certain requirements or not. An example of exempt waste is any waste that generates a significant exposure and may not be controllable within the standard requirements, such as the release of gases through building ventilation systems. This step ensures that proper risk assessment and safety measures are taken before proceeding with the

[32] IAEA (2000). "Safety Standards Series Regulatory Control of Radioactive Discharges to The Environment Safety Guide". (iaea.org). https://www.iaea.org/publications/5930/regulatory-control-of-radioactive-discharges-to-the-environment. [Accessed on August 6, 2024].

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disposal, and it helps to prevent hazardous or uncontrollable situations from occurring during the disposal process.

For waste with lower levels of radiation that do not pose a significant threat to the population, it may be classified differently, with less stringent requirements for disposal. In the case of radioactive waste, it is crucial to assess whether the practices in using the radioactive materials were conducted properly and safely. The next step involves identifying the primary exposure pathways, which could include ingestion, inhalation, or direct exposure to radiation. Following this, the radiation dose contained in the waste must be calculated, and the potential impacts on human health and the environment should be evaluated. Once the risks are understood, the appropriate disposal limits must be established, ensuring that the amount of waste being released into the environment stays within safe boundaries. This process ensures that radioactive waste disposal is managed responsibly, minimizing the potential for harm to humans and ecosystems.

The license holder and registrant are responsible during the disposal process, starting from reviewing the implications of changes in exposure pathways and changes in composition that affect the calculated dose, ensuring that the amount of waste complies with the maximum limits, and conducting regular monitoring of liquid waste and environmental radiation. This is because it is one of the requirements for the disposal permit, aimed at ensuring that the amount of waste disposed of is within the allowed limits.[33]

In the waste disposal process, there are situations where the amount released exceeds the predetermined capacity. In such cases, the license holder or registrant must investigate the cause, circumstances, and consequences, take immediate action to rectify the situation, and find solutions to prevent the same violation from happening again. The license holder must inform the regulatory body about the cause of the violation, the solutions, and the preventive measures that need to be implemented, and take any necessary actions required by the regulatory body. The action of providing information to the regulatory body must be done promptly because such a situation is considered an emergency, where exposure may have already occurred or is developing. If the preventive actions are delayed, the license will be revoked by the regulatory body. Such instances of non-compliance are unacceptable because the regulations established by the regulatory body are mandatory to follow.

In practice, incidents of releasing excessive waste into the environment occur due to residual contamination or multiple sources of contamination. The residual contamination is a result of accidents or doses determined based on previous standards.

[33] *Ibid.*

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Greenpeace, as a national environmental organization, argues that storing nuclear waste in a storage facility carries significantly lower risks compared to dumping the waste into the sea.[34]

Since dumping nuclear waste into the sea cannot be a long-term solution, the Japanese government has developed a high-level waste (HLW) management plan since 1976. The creation of a geological repository requires a lengthy process of research, determining suitable locations for disposal, and managing the disposal process. Therefore, not all countries can establish geological repositories. Currently, the organization responsible for waste management is the Nuclear Waste Management Organization of Japan (NUMO), which was established in October 2000 to implement the geological disposal of HLW. The construction of the geological disposal facility is expected to be completed by 2027.[35]

In the construction process, it is necessary to determine the location by considering the safety of both the public and the environment. The method designed for geological disposal is specifically for High-Level Waste (HLW) that contains strong radioactive elements. After the vitrification process, it emits 1.5 million millisieverts of radiation, which is equivalent to 150,000 (one hundred fifty thousand) CT scan X-rays and has the potential to cause death in just 20 seconds.[36] The deep-burial method is designed to address the high danger level posed by HLW. The HLW will be buried in deep layers, 300 meters (three hundred meters) below the ground. This method is specifically designed to avoid active fault lines and volcanic areas.[37] This method is also designed to protect human population safety for up to 100,000 years, by creating barriers with a 20 cm thick steel layer, which is then covered with a 70 cm thick layer of bentonite clay. In addition to the barriers, the HLW will be stored in stainless-steel tubes engineered to contain radionuclides and prevent direct contact with groundwater.[38] Looking at the Trail Smelter incident and several disputes related to environmental pollution, there are differences in the international legal instruments used by countries to resolve conflicts. These differences also show that the regulation of state responsibility for the disposal of nuclear-contaminated water from land-based sources is regulated by each country

[34] Yen-Chiang Chang, Xiaonan Zhao, Anqi Jian, Ying Tan, *Loc. Cit,* p. 2, see also, Greenpeace East Asia.
[35] Yuichiro Amekawa. (2002). "High-Level Radioactive Disposal Policy in Japan: A Sociological Appraisal".*Jurnal Hukum Ritsumeikan University.* https://www.mdpi.com/2071-1050/15/9/7732. see also, Sakamoto S, Kanda K, *Framework and communication for improving social adaptability of high-level radioactive waste disposal technology,* 2002.
[36] *Ibid.* See also, Kogi K. (2021). Nuclear Waste: Can Geological Disposal Ensure Safety for 100,000 Years? *Godo Shuppan Publishers.*
[37] *Ibid*, see also, Takeda, S. Regarding high-level radioactive waste: Focusing on long-term stability in geological environment. In Final Disposal of High-Level Radioactive Waste. *Japan Science Support Foundation.*
[38] *Ibid.*

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according to its own conditions and capabilities. Adopting international agreements to regulate the disposal of nuclear-contaminated water under national law is not a quick and short-term solution. However, the creation of international legal instruments that govern responsibility for nuclear waste could facilitate the resolution of disputes if damage occurs.[39]

Currently, due to the lack of a legal policy with provisions on state responsibility for nuclear waste disposal into the sea, the main step that neighboring countries of Japan can take if they feel harmed by the Japanese government's decision is to initiate negotiations with Japan. Based on UNCLOS Article 283, disputing states are required to exchange views and engage in discussions with each other to resolve the issue through international legal sources.[40] Just like Ireland seeking resolution under the OSPAR Convention, this legal source can be adapted by both countries. A country that feels harmed can take measures to monitor the risks and adverse effects that may result. Not only in the MOX plant case, but environmental pollution cases such as the Montara Oil Well case between Indonesia and Australia, and the Trail Smelter case, also show similarities in resolving issues. These similarities include conducting negotiations between countries, monitoring, and implementing preventive measures.

Resolving disputes through international courts to hold a country accountable for the damage caused is not straightforward. The ICJ has held that if the complainant cannot prove that the defendant directly caused harm to them, but only to the collective interest of all of humanity, the dispute cannot be resolved through the International Court of Justice (ICJ). A similar case to the Japanese government's situation is the MOX Plant case between Ireland and the United Kingdom. This case was brought before the International Tribunal for the Law of the Sea (ITLOS). Ireland argued that the nuclear activities carried out by the UK would damage marine ecosystems and fisheries interests. However, the challenge in bringing this lawsuit was the burden of proof, which Ireland failed to meet. As a result, ITLOS did not support Ireland's request to halt the operation of the MOX plant.[41]

According to Article 33 of the United Nations Charter, every state is obligated to settle disputes peacefully. This provision emphasizes the importance of diplomatic solutions and peaceful negotiation in resolving international conflicts, rather than resorting to force or other coercive measures. States are encouraged to seek peaceful

[39] Chang et al., "Frontier Issues in International Ocean Governance: Japan's Discharge of Nuclear Contaminated Water into the Sea."
[40] Ambarwati, "Penyelesaian Sengketa Pencemaran Laut Timor Akibat Kebocoran Sumur Minyak Montara Australia Antara Indonesia dan Australia."
[41] Chang et al., "Frontier issues in international ocean governance: Japan's discharge of nuclear contaminated water into the sea." *Loc. Cit,* p. 7.

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means such as negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement, or other peaceful methods to address their disputes.[42] Thus, negotiations between states become a peaceful solution for dispute resolution. Since UNCLOS 1982 does not regulate the amount of compensation to be provided to affected states, it only outlines the obligation of states to be accountable, each country can negotiate the amount of compensation based on the damages incurred. There is no mandatory procedure for dispute resolution, and the steps for settlement can be based on the mutual agreement of the involved states. This flexibility allows states to find a solution tailored to the specific circumstances and impacts of the dispute.

UNCLOS 1982 does not regulate the amount of compensation to be received by victims who suffer damages. However, Article 139 stipulates that the state causing the harm is obligated to compensate the affected state. Since the exact amount of compensation is not specified, negotiations between states can serve as a platform for discussing the compensation amount. Through negotiations, disputing countries can resolve the issue according to the capacities and circumstances of each state, ensuring a fair and mutually agreed-upon settlement.[43]

Here is a comparative overview of nuclear waste management regulations in several countries

Not only Japan, but also many large countries have utilized nuclear energy and generated substantial amounts of nuclear waste. These countries have established regulations to manage nuclear activities, though the management and liability regulations differ across nations. Some of the countries involved are:

1. **Canada**

   Canada is a country that produces 1.76 trillion becquerels of nuclear waste, a quantity comparable to that of Japan and France. Most of the high-level radioactive waste is generated from nuclear power plants (NPPs). The management of nuclear waste in Canada involves storing it in interim storage facilities through two phases: wet storage and dry storage.

   Since 2007, Canada has been developing geological-based regulations for nuclear waste. These regulations include **impact assessments** that set standards for evaluating the effects of government activities, including impacts on the environment, as well as on the health, social, or economic conditions in federal and provincial lands, and even beyond Canada's borders.[44]

[42] Ambarwati, "Penyelesaian Sengketa Pencemaran Laut Timor Akibat Kebocoran Sumur Minyak Montara Australia Antara Indonesia dan Australia.", see also, Charter of The United Nations, article 33.
[43] *Ibid,* UNCLOS'1982, article 139.
[44] Canada Justice Laws. (2019). "Impact Assessment Act". (laws.justice.gc.ca). https://laws-lois.justice.gc.ca/eng/acts/i-2.75/page-1.html. [Accessed on August 5, 2023]

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Canada regulates liability and compensation related to nuclear use with the goal of managing civil liability and providing compensation for damage caused by nuclear incidents. This regulation outlines the responsibilities of the state and the compensation amounts for the victims of such incidents.

Article 5 stipulates that nuclear incidents do not involve acts of war, hostilities, civil war, rebellion, or terrorism. This ensures that incidents arising from these circumstances are not covered under the nuclear liability and compensation framework.

Article 10 establishes **strict liability** for damages caused by nuclear incidents, meaning that the responsible parties are liable regardless of fault. This is designed to ensure that victims can receive compensation without having to prove negligence or fault on the part of the operator or the state.

Article 24, paragraph (1) sets out the compensation amounts for damages resulting from a nuclear incident: **$650 million** for nuclear incidents occurring within the first year after the regulations come into effect. **$750 million** for incidents occurring in the second year. **$850 million** for incidents in the third year. **$1 billion** for incidents occurring after the third year.

These amounts are intended to ensure that there is adequate compensation for victims, while also setting clear limits on liability for nuclear operators and the government. The regulation aims to balance the need for protection against nuclear risks with the ability to maintain a nuclear industry while safeguarding public health and the environment.[45]

2. United States

The United States is a country that heavily relies on nuclear energy and currently operates 93 nuclear power plants (NPPs). Like most countries, the U.S. uses nuclear energy for its environmental benefits, particularly because it generates power with relatively low greenhouse gas emissions. However, the growing volume of nuclear waste presents a significant environmental and safety challenge.

Similar to other nuclear energy-using nations, the U.S. has considered building a geological repository to store high-level nuclear waste. The U.S. government's plan was to create a permanent geological repository at **Yucca Mountain** in Nevada. This plan has faced significant opposition and legal

[45] Canada Justice Laws (2015). "Nuclear Liability and Compensation Act". (laws.justice.gc.ca). https://laws-lois.justice.gc.ca/eng/acts/n-28.1/fulltext.html. [Accessed on August 5, 2024].

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challenges, leading to delays and ultimately putting the project on hold.[46] The United States regulates compensation for individuals harmed by activities involving nuclear radiation under the **Radiation Exposure Compensation Act (RECA) of 1990**. This law was established to compensate individuals who were exposed to harmful radiation as a result of U.S. nuclear weapons testing and uranium mining.

The categories of victims and their compensation are as follows:

Uranium Miners, Millers, and Ore Haulers: Individuals involved in the uranium mining industry, including miners, millers, and transporters, who were exposed to harmful radiation, are eligible for compensation of **$100,000**.

People Living near Nuclear Test Sites: Individuals who lived in close proximity to locations where nuclear testing occurred, specifically those in affected areas, are eligible for **$75,000** in compensation.

Residents Downwind of Nuclear Testing (Nevada Test Site): People who lived in areas affected by radioactive fallout from the U.S. nuclear weapons tests, particularly those downwind of the Nevada test site, are eligible for **$50,000**.[47]

The growing amount of nuclear waste generated daily has led some countries to consider the disposal of nuclear waste into the environment. Building geological repositories for nuclear waste requires significant time, effort, and financial resources, making it unfeasible for all countries. Furthermore, not every country has suitable land or locations for such disposal facilities.

One example of such a challenge is seen in **Germany**, where the **Asse II** nuclear waste disposal site faced complications. Asse II was a former salt mine used for nuclear waste storage, but it later became contaminated with radioactive material. This contamination caused a mix of salt and waste that had to be separated and handled carefully. The cleanup and management of the waste became much more difficult and costly than initially anticipated, highlighting the challenges and risks associated with nuclear waste disposal. This situation underscores the complex and long-term nature of managing nuclear waste and the substantial financial and logistical investments required for safe and sustainable disposal solutions.

[46] Park, Sulgiye, Rodney C. Ewing. (2023). US Legal and regulatory framework for nuclear and future reactors and their fuel cycles. *Jurnal Annual Review* Volume 48. https://www.annualreviews.org/content/journals/10.1146/annurev-environ-112621-064435

[47] U.S Department of Justice (2023). "Radiation Exposure Compensation Act" .(justice.gov). https://www.justice.gov/civil/common/reca. [Accessed on August 8, 2024].

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The examples of **Canada** and **the United States** demonstrate that each country has its own regulations for managing and taking responsibility for nuclear waste, tailored to their individual capabilities and circumstances. While international uniformity in nuclear waste disposal regulations could provide a more cohesive and standardized approach, creating such a treaty would take considerable time and effort. In the meantime, countries have opted to develop their own mechanisms for accountability and responsibility.

CONCLUSION

Nuclear waste, which contains radiation, has long-term effects that are difficult to eliminate even with various processing technologies. Given the danger of radiation, which can harm human health and the environment continuously, using the ocean as a disposal site for nuclear waste cannot be justified and should not be considered a long-term solution. The ocean is a crucial and beneficial area for many countries. Polluting the Pacific Ocean, which is located near other countries, poses significant risks and can harm many parties, as well as endanger marine fauna. Therefore, the Japanese government's actions in dumping nuclear waste into the ocean must be stopped immediately. As a safer and more sustainable alternative, the construction of geological repositories could be a more appropriate solution for the long-term management of nuclear wast

Currently, there is no specific regulation that governs responsibility for nuclear waste pollution. Creating such regulation is not easy and requires a long period of time. However, having dedicated regulations in place could make it easier to address accidents that affect multiple countries. Furthermore, increasing international cooperation in the exchange of information, scientific research, and the development of safer and more responsible nuclear waste management technologies is essential. In cases involving nuclear waste, the precautionary principle should be consistently applied when making decisions about waste disposal, prioritizing prevention over mitigating environmental damage. It is important to strengthen the obligation for countries to take proactive measures to protect the oceans from nuclear waste pollution, including through the implementation of stricter emission standards and more comprehensive environmental monitoring.

Given the similarities in cases with the actions of the Japanese government, it is evident that there are challenges in proving responsibility and legal regulations due to the lack of specific international regulations. Therefore, a solution for neighboring countries that feel aggrieved by Japan's actions would be to initiate negotiations. Dispute resolution must be done peacefully between the two disputing countries, as stipulated

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in Article 33 of the UN Charter. By starting negotiations, the two countries can discuss compensation or find solutions to the grievances they experience. There is no mandatory procedure that a country must follow to resolve an issue; the resolution can be tailored based on the mutual agreement of the involved countries.

The Japanese government and neighboring countries can work together to find solutions and strengthen the role of the International Atomic Energy Agency (IAEA) in regulating and overseeing nuclear waste disposal in the sea, including clarifying standards and procedures that are stricter and legally binding. In cases where actions may potentially impact other countries, Japan must strengthen cooperation with its neighboring countries. It is essential to involve the public and neighboring nations in decision-making regarding nuclear waste management and ensure transparency in the data related to nuclear waste.

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